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ABSTRACT

Continuous Attitudinal Response Technology (CART) is an alternative approach to testing students' instantaneous response to teacher behaviors in the classroom. The system uses a microcomputer and video technology device that allows researchers to measure subjects' instantaneous responses to static and continuous stimuli, graphic or verbal. A typical session takes place in a focus-group facility or any environment conducive to small group interaction, such as a classroom. CART has proved useful in combining qualitative aspects of small group research and quantitative aspects of survey research. A pilot test of teacher story-telling using CART (with 96 subjects) provided support for previous findings and provided additional information about the differential impact of different story types on students' instantaneous learning. CART has also been used to test implicit communication theory in the classroom. A study determined 12 undergraduate subjects' emotional responses to an educational film about public speaking via CART. Results indicated that subjects' comprehension scores were lowest for material covered in the videotape when pleasure levels were lowest. Efforts are underway to expand research in communication and education using CART technology. (Thirty-seven references are attached.) (RS)

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OVERCOMING RESEARCH DESIGN PROBLEMS VIA METHODOLOGICAL INTEGRATION: USE OF COMPUTER ASSISTED TECHNOLOGIES IN STUDYING TEACHER BEHAVIORS

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Running Head: Overcoming

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Abstract

Communication and education research results have been limited by data collection methods. For example, most of the research in teachers' classroom behaviors is based on data collected from students, usually with pencil/paper surveys. The purpose of this paper is to describe an alternative, integrated approach to research designs through the use of CART$_{tm}$ technology. CART$_{tm}$ provided researchers with the opportunity to combine traditional survey methodology with small group, qualitative methods. This integrated approach overcame limitations experienced when either approach is exclusively used. In addition, it provided instantaneous, moment-by-moment subject reactions to educational messages and teachers. Initially, CART$_{tm}$ is described. Then, results of its application in two studies are provided.

OVERCOMING RESEARCH DESIGN PROBLEMS VIA METHODOLOGICAL INTEGRATION: USE OF COMPUTER ASSISTED TECHNOLOGIES IN STUDYING TEACHER BEHAVIORS

"Let the question determine the method" is a basic tenet in research methodology. In other words, a thorough understanding of the research question or problem should precede the choice of method of inquiry and the means for interpreting results. On occasion, however, studies appear to be method-driven rather than question-driven. Once a particular design or method of inquiry is learned and practiced, that method becomes comfortable. Often this leads to its exclusive use, independent of the particular demands of the question, a process Kaplan (1964) has termed "the law of the instrument".

Several problems emerge from such a practice. Exclusivity in methods causes researchers to overlook potential advantages of an integrated approach, thus decreasing the reliability and generalizeability of results and precluding a fuller account of the phenomenon in question with enhanced reliability and validity. When attempting to test an intricate theory, for example, one that explains such a complex phenomenon as the teaching-learning process, communication researchers usually tend to either survey students' or teachers perceptions or observe teachers behaviors and link them to student learning. Most recent article by Nussbaum (1992) reviewed published studies that examined teachers' behaviors in the classroom. Surprisingly over 75% of these articles relied on students' perceptions of teacher behaviors while the other portion observed teacher activities in

the classroom.

Pencil and paper methods (measuring perceptions) generally tap a global or holistic reaction to teachers' behaviors. Quite often this approach is problematic, in that, typically, the data are collected after teacher has presented her/his lecture. In addition to global, holistic responses, however, researchers fail to recognize that students react to teachers' presentations instantaneously and in an ongoing fashion. Asking subjects to recall what they felt at a previous moment in time engages a cognitive filtering process several steps removed from the actual reactions registered at the time, thus providing a limited view of the phenomenon and shedding little light on the theory in question.

Currently used qualitative and quantitative research methods used in studying teacher behaviors are unable to instantly measure students' responses as they occur across time. The purpose of this paper is to outline an alternative approach to testing students instantaneous response to teacher behaviors in the classroom. The methodology combines both qualitative and quantitative research techniques in a creative way using computer assisted technology called "Continuous Attitudinal Response Technology" ($CART_{tm}$). First, the paper first outlines $CART_{tm}$'s configurations and use. Second, the implicit communication theory is outlined as an example how researchers have used qualitative or quantitative approaches in studying teacher behaviors. Finally, the results of two recent pilot studies examining implicit communication theory via $CART_{tm}$ provides an

illustration of advantages in integrative research design (Javidi, Long, Vasu, & Ivy, 1991).

What is Continuous Attitudinal Response Technology

Continuous Attitudinal Response Technology ($CART_{tm}$) is a system that allows combined qualitative and quantitative research methods when used in small, focus group settings (Vasu, Long, & Hughes, in press). The system uses a microcomputer and video technology device that allows researchers measure subjects' instantaneous responses to static and continuous stimuli, graphic or verbal (e.g., teacher presentations and teaching materials). This is done by allowing subjects to turn a dial on a hand-held keypad or pressing a button on their individual response devices. The responses are typically "captured" at intervals as frequent as 1 per second (responses may be captured more or less frequently, contingent upon research needs) and fed into a microcomputer with customized software that analyzes subject responses and provides printed output (Javidi, Long, Vasu, & Ivy, 1991). The data set is kept in an ASCII file and can be easily transformed for use in spreadsheet programs or statistical processing packages.

The $CART_{tm}$ provides a combination of continuous curves, response category bar graphs, significance of difference plots, and options for numerical output (e.g., frequencies, means, etc.) by individual or crosstabulated demographic and psychographic categories. These outputs are immediately superimposed over videotape (stimulus) for researchers and visual playback to subjects. After responding to a given stimulus, subjects are

debriefed. During this phase in-depth probing is used to investigate subjects' reasons for their reactions.

In summary, CART$_{tm}$ allows for continuous measurement and display of aggregate (all subjects), subgrouped (e.g., men and women, liberals, moderates, and conservatives, etc), and individual responses. The technology provides "real-time, instant feedback polling" in which subjects review their reactions to stimuli and are probed for motives that prompted their responses. Responses are uncontaminated by subject interaction since group interaction occurs after data collection. This feature overcomes a typical problem experienced in general focus group settings in which the dominant group member has the capacity to influences others' reactions to stimuli.

Procedures in a Typical CART$_{tm}$ Session

A typical session takes place in a focus-group facility or any environment conducive to small group interaction (i.e., classroom). Typically, subjects sit around a table or in a "theater-type" configuration while being directed by a moderator. Technological advances in audio/video and computer hardware has allowed "parachuting" of a CART$_{tm}$ system into virtually any location. Additionally, communications networks and facilities, such as the U.S. Sprint meeting Rooms, allow groups at several locations to simultaneously participate in a CART$_{tm}$ session (Javidi, Long, Vasu, & Ivy, 1991). This permits data collection from all this locations using Research Triangle Park as the research site. Thus, a researcher can gather data and test messages from the Research Triangle Park, North Carolina, control

center in geographically remote locations without traveling.

Subjects receive instructions for using hand-held devices and practice with sample survey questions and stimulus materials. The training period takes approximately 10 minutes. After training, demographic and psychographic survey questions (entered a'priori into the computer) are sent to the subjects via video monitor. Subjects respond to the questions by entering their choices via the CART$_{tm}$'s hand-held device. Their responses provide researchers with opportunities for creating subgroups based upon survey item responses. Demographic and psychographic subgroupings become a part of the overlay tape that is created when "dialed" or continuous reactions to the stimuli are collected.

At the conclusion of each stimulus segment (e.g., teachers discussion of very important concept) subjects are often given a post-test. Pre- and post-testing provide the means for determining if the stimulus material (teacher's presentation) had an impact on students' learning. Collectively, these responses become the vehicle for in-depth probing during the debriefing session (this is videotaped for the purpose of content analysis). During this stage subjects are shown the group's mean response (moving graph) as an overlay on the actual stimulus. Subjects are asked to discuss reasons for their responses. A researcher physically separated from the group has information about individual and sub-group responses (Subjects are shown aggregate responses). This researcher, via a wireless communication, provides information to the moderator about individual and

subgroup deviations and assists in directing the debriefing session.

$CART_{tm}$ has proved useful in combining qualitative aspects of small group research and quantitative aspects of survey research. Thus, inherent limitations of each methodological approach are overcome and the advantages of each are realized. The remainder of this paper provides two examples of applications in the classroom. The first briefly describes a pilot study of teachers' classroom story-telling and the impact on learning outcomes. Discussion of the second application is done in greater detail to describe the rationale for and a test of implicit communication theory in the classroom.

Application One: Pilot Test of Teacher Story-Telling

Schrag, Javidi, Long, and Vasu (1991) investigated the immediate and cumulative impact of teachers' storytelling on students' learning. Ninety-six students at enrolled at a large Southern university were randomly assigned to 4 different treatment groups. Subjects in each group were then asked to watch and respond to (via Continuous Audience Response Technology) one of the four videotaped presentations. In the presentations a teacher delivered the same lecture supported by 4 different types of narratives (expository, self-disclosive, cultural, and Self-disclosive/cultural).

Subjects' responses to each presentation were recorded every 1/5 of a second, providing a continuous plot, in real time, to the messages in the stimuli. Subjects were then tested on the stimulus content (i.e., comprehension) and attitudes toward the

teacher. Finally, a focus group format was used to debrief the subjects and clarify their responses. Although, the study provided support for previous findings, it provided additional information about the differential impact of different story types on students' instantaneous learning. For example, analysis of moment-to-moment responses via CART$_{tm}$ revealed that student comprehension was highest when cultural stories were told. Analyses of qualitative and quantitative information indicated that cultural stories stimulated emotions positively and provided information in a more understandable format when contrasted to other narrative formats. In contrast, when historical narratives were shared, moment-to-moment reactions were less positive, subjects expressed confusion (during debriefing), and comprehension was lowest among all narrative formats.

Application Two: Implicit Communication Theory in the Classroom

Several studies using qualitative or quantitative approaches have investigated implicit communication theory. This theory (originally developed by Mehrabian, 1981) describes messages which elicit emotions and attitudes/ preferences, and which are related to higher order, cognitive reactions (Beebe & Biggers, 1988; Mehrabian, 1980, 1981; Russell, 1980; Zajonc, 1980). Emotion is conceptualized in terms of three factors or dimensions: pleasure-displeasure, arousal-nonarousal, and dominance-submissiveness (Mehrabian, 1976; Mehrabian & Russell, 1974; Osgood, May, & Miron, 1975; Russell, 1978; Russell & Mehrabian, 1974; 1977).

In the classroom context, implicit communication theory suggests that teacher behaviors communicate messages along the three continua of emotion. Pleasant facial expressions, vocal qualities, and verbal reinforcement generate pleasurable feelings in students, whereas disgusted expressions or angry vocal tones generate displeasure (Eibl-Eibesfeldt & Hass, 1967; Ekman, Sorensen, & Friesen, 1969; Hass, 1970; Riskin & Faunce, 1972; Tomkins, 1962; Vine, 1973). Certain teacher behaviors lead to a more activated, aroused state in students, such as a dynamic lecture or a discussion session. Likewise, certain teacher behaviors engender in students a sense that they are not powerless in a classroom, they have some degree of control over what they are learning and how they will respond and perform in a classroom (dominance dimension).

Immediacy provides the clearest illustration of a potential connection between implicit communication theory and constructs that explain the teacher behavior-student learning link. All of the constructs under the rubric of immediacy suggest that teacher approach behaviors communicate messages of liking (Andersen, 1979; Andersen & Andersen, 1982; Andersen & Andersen, 1987; Andersen, Norton, & Nussbaum, 1981). Some researchers suggest that teachers' communication of liking increases students' affective and/or cognitive learning (Christophel, 1990; Gorham, 1988; Gorham & Christophel, 1990; Gorham & Zakahi, 1990; Ivy & Butland, 1989; Kearney, Plax, & Wendt-Wasco, 1985; Powell & Harville, 1990; Richmond, Gorham, & McCroskey, 1987; Sanders & Wiseman, 1990). In terms consistent with implicit communication

theory, teacher approach behaviors elicit student approach behaviors, both toward the teacher and course content. In essence, a teacher's immediate behavior results in a pleasurable, liking, aroused, dominant, emotional response in his/her students. The notion that this implicit reaction to teacher behavior stimulates learning is plausible and testable.

Research has begun to provide initial support for implicit communication theory as a paradigm for explaining the teaching-learning connection. Gorham (1988) incorporated Mehrabian's theoretical work into her research on the link between teacher verbal and nonverbal immediacy and student learning. Upon documenting a relationship between teacher immediacy behaviors and student learning, Gorham concluded that "immediacy items identified in this study are intuitively compatible with Mehrabian's (1981) approach-avoidance metaphor. Within this frame, the relationship of verbal (and nonverbal) teacher immediacy behaviors to affective learning is patently logical" (p. 52).

A recent test of implicit communication theory was conducted by Butland (1991). This study replicated Gorham's (1988) research, but also measured students' emotional responses to teacher immediacy behavior in implicit communication terms (Mehrabian's approach-avoidance metaphor). Results of the study replicated Gorham's (1988) findings, significantly linking teacher verbal and nonverbal immediacy to gains in student learning. However, when immediacy constructs were replaced with scales tapping the dimensions of pleasure, arousal, and

dominance, results were more illuminating. Student responses on pleasure and arousal scales accounted for over one-half of the variance of learning in this study. The combined results for immediacy and for pleasure and arousal dimensions only increased the variance explained by two percent (52% total variance explained). Thus, Butland (1991) provided evidence to document the explanatory power of implicit communication theory with regard to the teaching-learning relationship. Teacher behavior appeared to affect students emotionally. And, emotional fluctuations are linked to perceptions about the teacher and the amount of learning that occurs. While the two studies cited above focused on implicit communication theory and instruction, they both employed traditional research methods.

In the second application, Ivy, Beebe, Friedrich, Javidi, and Biggers (1991) sought to: (1) determine subjects' emotional responses to an educational film about public speaking via $CART_{tm}$; (2) compare responses produced by $CART_{tm}$ with responses to a traditional scale; and (3) compare subjects' responses graphed by $CART_{tm}$ to their answers on a comprehension test.

Twelve undergraduate students (33% female; 67% male) who had completed an introductory public speaking course participated in the pilot study. They Subjects viewed a 15-minute instructional videotape on preparing a public speech and reacted to it via $CART_{tm}$ in respect to pleasure or displeasure they felt during the videotape. Mehrabian's (1981) Verbal Report of the Pleasure Dimension of Emotional State was completed by the students after the completion of the videotape. Subjects also completed six

multiple choice questions designed to test their comprehension of material specific to the videotape. Subjects were debriefed while reviewing overlay graph on videotape, stopping the tape at various points and asking subjects what caused their reactions. Results revealed that at a specific point in the videotape, subjects expressed greater pleasure than other points. Interestingly, subjects' comprehension scores were lowest for material covered in the videotape when pleasure levels were lowest.

Discussion

Existing problems in education and communication research methods led to application of CART$_{tm}$'s integrated methodological approach in studying teacher story-telling and implicit communication theory in the classroom. Although research methods seek to minimize error of measurement while gaining some understanding about variable relationships, all fail in some way. In traditional survey research, measurement problems may occur because the method requires filtered subject recall of a previous experience. The continuous, moment-to-moment measurement of reactions to stimuli adds a new dimension to educational research and provides depth that previously not experienced.

Currently, efforts are underway to expand research in communication and education using CART$_{tm}$ technology. Initially, the research program will be aimed at assessing psychometric issues associated the data collection technique, subject-equipment interface, and potential contaminants of subject responses. In addition, large psychographic subgroupings are

being tested to determine what cognitive and personality variables may confound the collection technique.

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